

# 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U

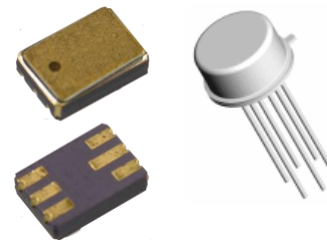


## NPN Dual Silicon Transistors

Rev. V1

### Features

- Available in JAN, JANTX, JANTXV, JANS and JANSR per MIL-PRF-19500/355
- TO-78 and U package types
- Radiation Tolerant Levels M, D, P, L, and R



### Electrical Characteristics ( $T_A = +25^\circ\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Base Cutoff Current	$V_{CB} = 70 \text{ V dc}$	$I_{CBO1}$	$\mu\text{A dc}$	—	10
Emitter - Base Cutoff Current	$V_{EB} = 6 \text{ V dc}$	$I_{EBO1}$	$\mu\text{A dc}$	—	10
Breakdown Voltage, Collector-Emitter	$I_C = 10 \text{ mA dc}$	$V_{(BR)CEO}$	$\text{V dc}$	60	—
Collector - Base Cutoff Current	$V_{CB} = 45 \text{ V dc}$	$I_{CBO2}$	$\text{nA dc}$		2
Collector - Emitter Cutoff Current	$V_{CE} = 5 \text{ V dc}$	$I_{CEO1}$	$\text{nA dc}$		2
Emitter - Base Cutoff Current	$V_{EB} = 5 \text{ V dc}$	$I_{EBO2}$	$\text{nA dc}$		2
Forward - Current Transfer Ratio 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U	$V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}$	$h_{FE1}$		60 175	240 600
Forward - Current Transfer Ratio 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U	$V_{CE} = 5 \text{ V dc}; I_C = 100 \mu\text{A dc}$	$h_{FE2}$		100 235	325 800
Forward - Current Transfer Ratio 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}$	$h_{FE3}$		150 300	600 1000
Base - Emitter Saturation Voltage	$I_C = 1.0 \text{ mA dc}; I_B = 100 \mu\text{A dc}$	$V_{BE(sat)1}$	$\text{V dc}$	0.5	1.0
Collector - Emitter Saturation Voltage	$I_C = 1.0 \text{ mA dc}; I_B = 100 \mu\text{A dc}$	$V_{CE(sat)1}$	$\text{V dc}$	—	0.3
Forward-Current Transfer Ratio (Gain Ratio)	$V_{CE} = 5 \text{ V dc}; I_C = 100 \mu\text{A dc}$	$\frac{h_{FE2-1}}{h_{FE2-2}}$		0.9	1.1
Absolute Value of Base Emitter-Voltage Differential	$V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}$	$ V_{BE1} - V_{BE2} $	$\text{mV dc}$	—	5

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### Electrical Characteristics ( $T_A = +25^\circ\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Absolute Value of Base Emitter-Voltage Differential	$V_{CE} = 5 \text{ V dc}; I_C = 100 \mu\text{A dc}$	$ V_{BE1}-V_{BE2} _2$	mV dc	—	3
Absolute Value of Base Emitter-Voltage Differential	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}$	$ V_{BE1}-V_{BE2} _3$	mV dc	—	5
Base-Emitter-Voltage (Nonsaturated) (Absolute Value of Differential Change with Temperature)	$T_A = +150^\circ\text{C}$ $V_{CE} = 500 \text{ V dc}; I_C = 100 \mu\text{A dc}$ $T_A = +125^\circ\text{C}$ and $+25^\circ\text{C}$	$ \Delta V_{BE1}-V_{BE2}\Delta T_A _2$	mV dc	—	1
Collector - Base Cutoff Current	$T_A = +150^\circ\text{C}$ $V_{CB} = 45 \text{ V dc}$	$I_{CBO3}$	$\mu\text{A dc}$	—	2.5
Forward Current Transfer Ratio 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U	$T_A = -55^\circ\text{C}$ $V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}$	$h_{FE4}$		20 50	
Base-Emitter-Voltage (Nonsaturated) (Absolute Value of Differential Change with Temperature)	$T_A = -55^\circ\text{C}$ $V_{CE} = 5 \text{ V dc}; I_C = 100 \mu\text{A dc}$ $T_A = +25^\circ\text{C}$ and $-55^\circ\text{C}$	$ \Delta V_{BE1}-V_{BE2}\Delta T_A _1$	mV dc	—	0.8
Small-Signal Short-Circuit Input Impedance	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}; f = 1 \text{ kHz}$	$h_{ie}$	k $\Omega$	3	30
Small-Signal Open-Circuit Reverse Voltage Transfer Ratio	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}; f = 1 \text{ kHz}$	$h_{re}$			$1 \times 10^{-3}$
Small-Signal Open-Circuit Output Admittance	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}; f = 1 \text{ kHz}$	$h_{oe}$	$\mu\text{mhos}$	—	60
Small-Signal Short-Circuit Forward Current Transfer Ratio (magnitude $h_{fe}$ )	$V_{CE} = 5 \text{ V dc}; I_C = 0.5 \text{ mA dc}; f = 20 \text{ MHz}$	$ h_{FE} $		3	20
Open Circuit Output Capacitance	$V_{CB} = 5 \text{ V dc}; I_E = 0 \text{ mA}; 100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	$C_{obo}$	pF	—	5
Noise Figure	$V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}; R_g = 10\text{k}\Omega$				
Test 1	$f = 100 \text{ Hz}$	F1	dB	—	5
Test 2	$f = 1 \text{ kHz}$	F2	dB	—	3
Test 3	$f = 10 \text{ kHz}$	F3	dB	—	3
Collector - Emitter Cutoff Current	$V_{CE} = 40 \text{ V dc}$	$I_{CES}$	nA dc	—	20

# 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U



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### Absolute Maximum Ratings ( $T_A = +25^\circ\text{C}$ unless otherwise specified)

Ratings	Symbol	Value
Collector - Emitter Voltage	$V_{CEO}$	60 V dc
Collector - Base Voltage	$V_{CBO}$	70 V dc
Emitter - Base Voltage	$V_{EBO}$	6.0 V dc
Collector Current	$I_C$	30 mA dc
Total Power Dissipation @ $T_A = +25^\circ\text{C}$ One Section Both Sections	$P_T(1)$	200 mW 350 mW
Total Power Dissipation @ $T_C = +25^\circ\text{C}$ One Section Both Sections	$P_T(2)$	300 mW 450 mW
Thermal Resistance Junction to Ambient One Section Both Sections	$R_{\theta JA}$	875°C/W 500°C/W
Thermal Resistance Junction to Case One Section Both Sections	$R_{\theta JC}$	583°C/W 388°C/W
Operating & Storage Temperature Range	$T_J, T_{STG}$	-65°C to +175°C

(1) For  $T_A > +25^\circ\text{C}$ , derate linearly 1.143 mW/°C, one section, 2.000 mW/°C, both sections

(2) For  $T_C > +25^\circ\text{C}$ , derate linearly 1.714 mW/°C, one section, 2.571 mW/°C, both sections

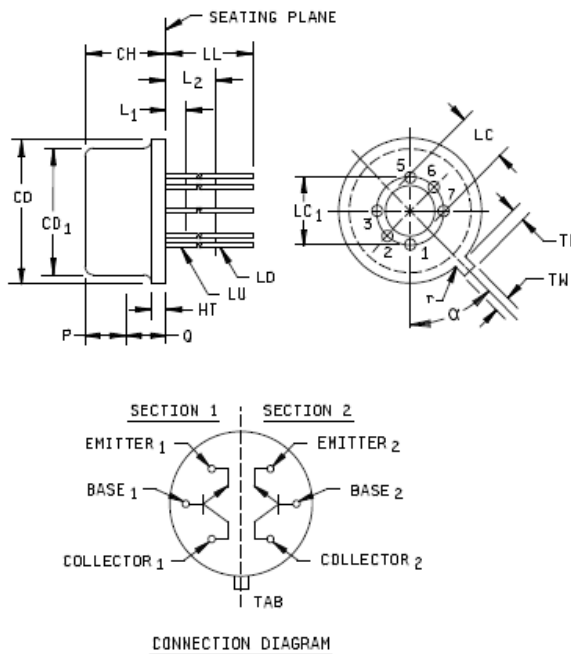
# 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U



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### Outline Drawing (TO-78)



Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.335	.370	8.51	9.40	
CD <sub>1</sub>	.305	.335	7.75	8.51	
CH	.140	.260	3.56	6.60	
HT	.009	.041	0.23	1.04	
LC	.140	.160	3.56	4.06	
LC <sub>1</sub>	.200 TP		5.08 TP		9
LD	.016	.021	.041	0.53	10
LL	See notes 10, 11, and 12				
LU	.016	.019	0.41	0.48	10
L <sub>1</sub>	.050		1.27		10
L <sub>2</sub>	.250		6.35		10
P	.100		2.54		8
Q		.050	1.27		7
TL	.029	.045	0.74	1.14	5, 6
TW	.028	.034	0.71	0.86	4, 5
r		.010	0.25		
$\alpha$	45°TP		45°TP		9

#### NOTES:

- Dimensions are in inches.
- Millimeters are given for general information only.
- Tab shown omitted.
- Lead numbers 4 and 8 are omitted on this variation.
- Beyond r maximum, TW shall be held to a minimum length of .21 inch (5.33 mm).
- TL shall be measured from maximum CD.
- Details of outline in this zone are optional.
- CD<sub>1</sub> shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
- Leads at gauge plane .054 - .055 inch (1.37 - 1.40 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at a maximum material condition (MMC) relative to the tab at MMC. The device may be measured by direct methods or by the gauge and gauging procedures described on gauge drawing GS-1.
- LU applies between L<sub>1</sub> and L<sub>2</sub>. LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> and beyond LL minimum.
- For transistor types 2N2919 and 2N2920, LL is .500 inch (12.70 mm) minimum and .750 inch (19.05 mm) maximum.
- For transistor type 2N2919L and 2N2920L, LL is 1.500 inches (38.10 mm) minimum and 1.750 inches (44.45 mm) maximum.
- In accordance with ASME Y14.5M, diameters are equivalent to  $\phi$ x symbology.

FIGURE 1. Physical dimensions 2N2919, 2N2919L, 2N2920, and 2N2920L (TO-78).

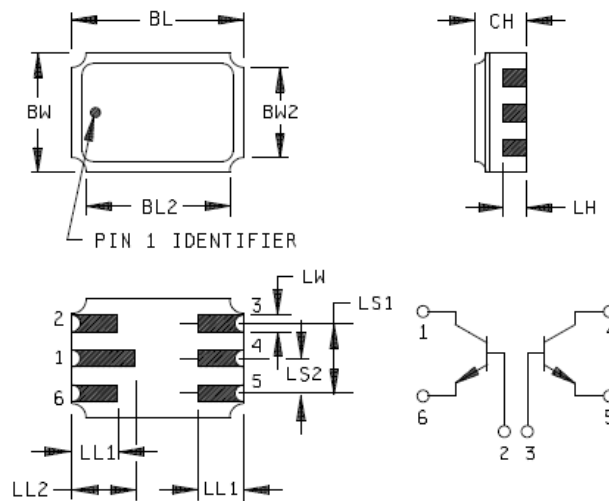
# 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U



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### Outline Drawing (U)



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.240	.250	6.10	6.35
BL <sub>2</sub>		.250		6.35
BW	.165	.175	4.19	4.44
BW <sub>2</sub>		.175		4.44
CH	.044	.080	1.12	2.03
LH	.026	.039	0.66	0.99
LL <sub>1</sub>	.060	.070	1.52	1.78
LL <sub>2</sub>	.082	.098	2.08	2.49
LS <sub>1</sub>	.095	.105	2.41	2.67
LS <sub>2</sub>	.045	.055	1.14	1.39
LW	.022	.028	0.56	0.71

Pin no.	Transistor
1	Collector no. 1
2	Base no. 1
3	Base no. 2
4	Collector no. 2
5	Emitter no. 2
6	Emitter no. 1

#### NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.

FIGURE 2. Physical dimensions (2N2919U and 2N2920U) surface mount.

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## Thermal Impedance Curves

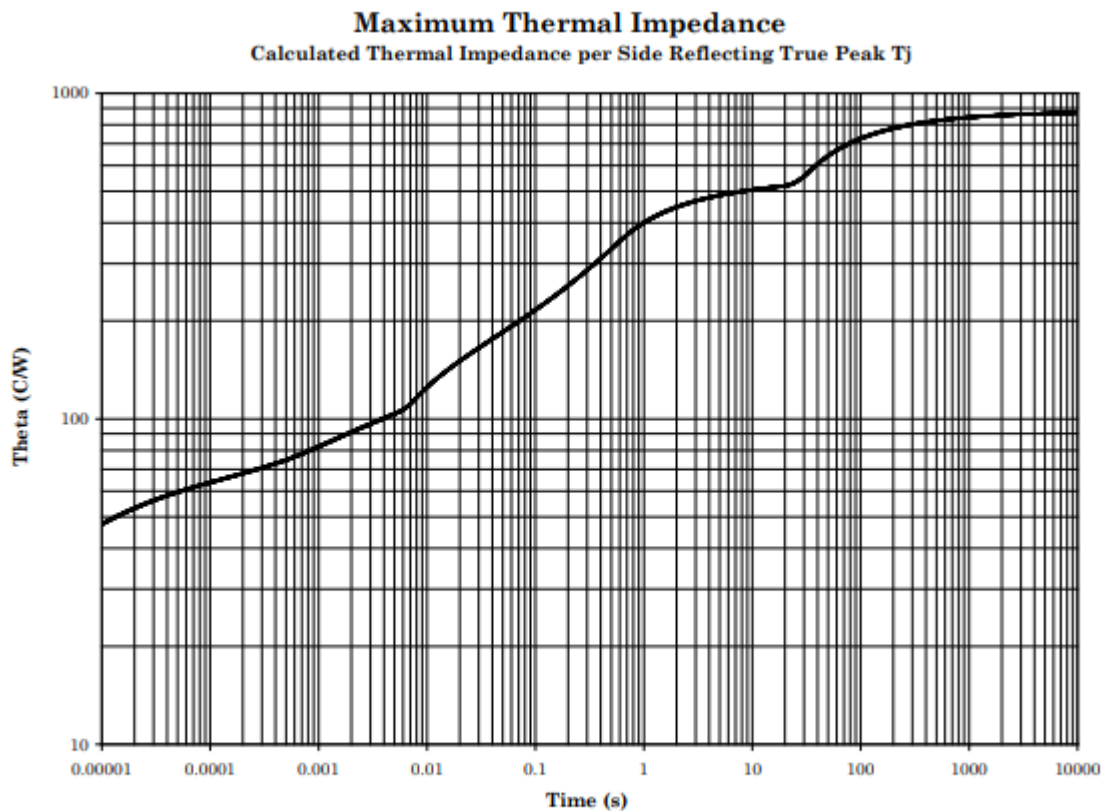


FIGURE 6. For each side: Thermal impedance = 875°C/W, Pt = 200 mW.

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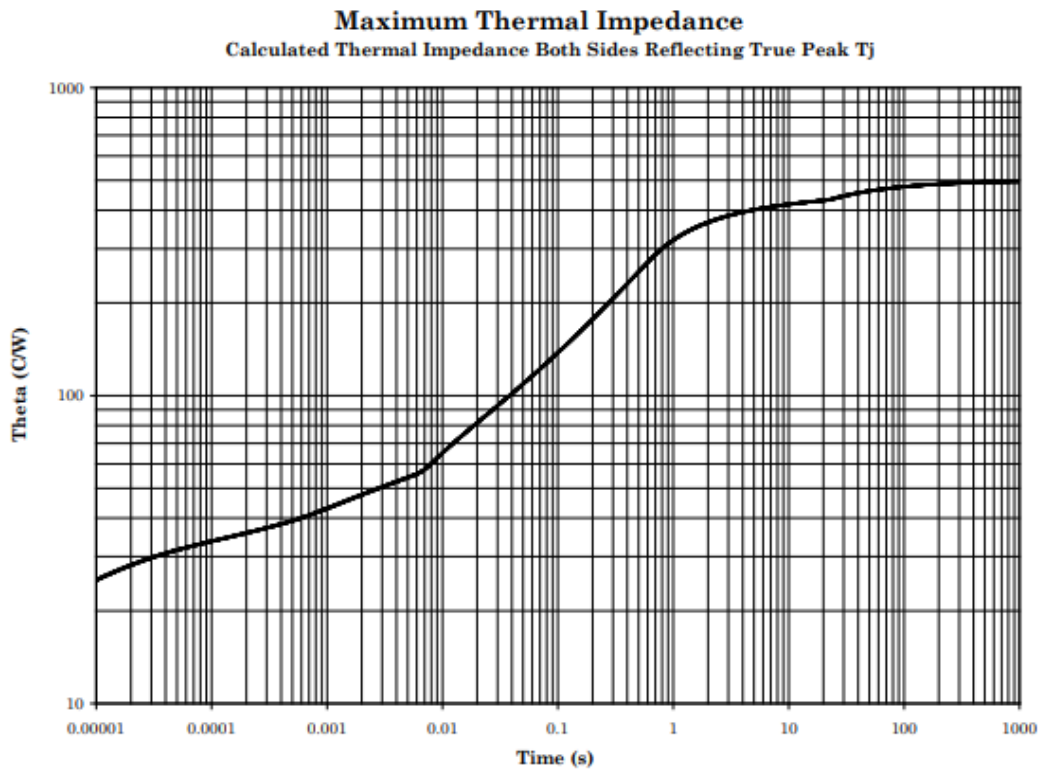


FIGURE 7. Both sides: Thermal impedance = 500°C/W, P<sub>t</sub> = 350 mW.

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